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# Neighbourhood characteristics and 10-year risk of depression in Canadian adults with and without a chronic illness

Genevieve Gariepy [a,*], Alexandra Blair [b], Yan Kestens [c], Norbert Schmitz [a,b]

[a] Department of Epidemiology and Biostatistics, McGill University, Montreal, QC, Canada
[b] Department of Psychiatry, McGill University, Montreal, QC, Canada
[c] Department of Social and Preventative Medicine, University of Montreal, Montreal, QC, Canada

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ABSTRACT

The neighbourhood environment could play a role in the risk of depression in adults and those with a chronic illness. We investigated the effects of a range of neighbourhood characteristics on the 10-year risk of depression in a representative sample of 9026 Canadian adults and subsamples with a chronic condition. Characteristics of neighbourhoods were not significantly related to the risk of depression in the general sample and subsamples with a chronic condition. However, residing near a park was significantly associated with a lower risk of depression for people living in crowded households, and having a local health service nearby was protective for those living in materially deprived neighbourhoods. Living in a neighbourhood that was both socially advantaged and offered cultural services was also associated with lower risk of depression. Additional research is needed for smaller effect size detection. Future intervention research is warranted for health policy recommendations.



## 1. Introduction

Depression is an important public health concern and the leading cause of disability worldwide (World Health Organization, 2012). The prevalence of depression is about 5% in Canadians 15 years and older, with evidence suggesting that up to 1 in 3 individuals will experience high depressive symptoms during their lifetime (Public Health Agency of Canada, 2013). While considerable research has been carried in the etiology of depression, a growing area for research is the role of the neighbourhood environment. Evidence suggests an association between aspects of the neighbourhood and depressive symptoms (Julien et al., 2012; Mair et al., 2008). However, research has mainly focused on neighbourhood deprivation and poverty from census data. Little is known about the role of physical features of neighbourhoods. Neighbourhood green spaces could offer reprieve from stress and support mental health (Lee and Maheswaran, 2011). Local parks and libraries is hypothesized to promote social cohesion, trust and contact (Wavell et al., 2002), which in turn could protect against depression. Neighbourhoods that offer a variety of walking destinations also facilitate social contact and promote active transportation (Wendel-Vos et al., 2007), which is in turn associated with mental health (Mammen and Faulkner, 2013). The definition of neighbourhoods is also a point of debate in the literature (Osypuk and Galea, 2007). The majority of previous studies have employed administrative geographic units (e.g., census tracts) as a crude proxy to neighbourhoods, but neighbourhood definitions centered around the individual may more accurately capture the neighbourhood environment involved in health (Mair et al., 2008; Osypuk and Galea, 2007).

The neighbourhood context may be particularly important to individuals living with a chronic condition who may have limited mobility, and often rely on their local resources for disease management and support. Individuals with a chronic condition are a growing subpopulation and are particularly vulnerable to depression (Anderson et al., 2001; Lichtman et al., 2008; Yohannes et al., 2010). Patients are often told to self-manage their chronic illness through healthy lifestyle changes, such as diet and exercise. Yet, limited availability of healthy food stores or places to exercise may represent important barriers to managing a chronic disease (Brown et al., 2007), which could lead to distress. Limited availability of health care services may also hinder disease management, leading to greater risk of disease complications, loss of function, and depression. Depression can in turn substantially complicate the adjustment, disease course and health outcomes of people with a chronic condition. An understanding of the wider neighbourhood factors contributing to depression in people with a

* Correspondence to: Douglas Mental Health University Institute McGill University, 6875 LaSalle Boulevard Montreal, Quebec, Canada H4H 1R3. Tel.: +1 514 761 6131x6160; fax: +1 514 888 4064.
*E-mail address:* genevieve.gariepy@mail.mcgill.ca (G. Gariepy).

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chronic condition therefore has important clinical and public health implications. Previous work exists on the association between neighbourhood features and depression in adults with arthritis (Martin et al., 2010), systemic lupus (Trupin et al., 2008), asthma (Yen et al., 2008, 2006) and diabetes (Gary-Webb et al., 2011), but information is missing on other common chronic conditions, such as cardiovascular disease and gastrointestinal problem. Evidence has so far been cross-sectional, except for one study (Yen et al., 2008), and little is known on the neighbourhood characteristics that might contribute to the risk of depression in subgroups of people with a chronic condition.

In addition to subgroups with a chronic illness, there may be sociodemographic groups that are more vulnerable to the effect of the neighbourhood environment. Studies report different associations by sex (Burke et al., 2009; van Praag et al., 2009), age group (Ahern and Galea, 2011), socioeconomic status (Burke et al., 2009; Stafford et al., 2008; Weich et al., 2003), and social support (Ross and Jang, 2000). For example, sex differences may exist because of gender-based societal expectations around family caregiving. Women may be more likely to be affected by neighbourhood factors that negatively impact their family, such as lack of safe play areas for children (Blocker and Eckberg, 1989; Burke et al., 2009). A sense of control over life is also known to protect against the deleterious effects of stress (Thoits, 1995), which may include environmental stress. There is also evidence that housing conditions are linked to psychological distress (Evans, 2003) and may amplify neighbourhood effects. Finally, neighbourhood characteristics may interact with one and another to affect depression.

In the present study, we combined 10 years of follow-up data from a large Canadian health survey with census, geospatial and satellite imagery data to investigate the effects of a wide range of neighbourhood characteristics on depression. We delineated neighbourhoods using a person-centered definition. Our first aim was to investigate the association of a comprehensive range of neighbourhood characteristics with the risk of depression in a representative sample. Our second aim was to study these associations in subgroups with a common chronic condition. Our third aim was to examine the potential moderating effect of individual-, household- and neighbourhood-level characteristics on the associations. We hypothesized that neighbourhood characteristics could be significant risk factors for depression and that this effect would be amplified in vulnerable subgroups, particularly in those with a chronic condition.

## 2. Methods

### 2.1. Study population

We used data from the National Population Health Survey (NPHS), a nationally representative cohort study of individuals across Canada ($n=17,276$). The NPHS used a stratified cluster sampling strategy (Statistics Canada, 2011). Follow-up interviews were conducted every 2 years. The NPHS collected data from 1994/95 to 2010/11. Because data on the neighbourhood environment were available starting in 2000/2001, we used NPHS data from 2000/2001 to 2010/2011 in this study, corresponding to NPHS cycles 4–9 (response rates 85%, 81%, 78%, 77%, 71% and 70%, for cycles 4 to 9, respectively). To insure comparability with other studies, we included adults who were between the ages of 18 and 80 at baseline ($n=13,618$). Because we were interested in incidence of depression, we excluded participants with depression during the previous survey cycles (1994/95 to 2000/01) ($n=2422$) and those with missing information on depression for 2 cycles or more ($n=2145$). We also excluded participants who were institutionalized at study baseline because we were interested in community-dwellers ($n=25$). Our final cohort included 9026 individuals with 10 years of follow-up. A flowchart of participant selection is available in Supplementary Table 1. Study protocols were approved by the Research Ethics Committee of the Douglas Mental Health University Institute.

### 2.2. Depression

The outcome of interest was depression, defined as meeting symptoms for either minor or major depressive disorder. This definition was selected because it captures the larger spectrum of depression disorder thought to be important to health outcomes (Kessler et al., 1997; Meeks et al., 2011; Rodriguez et al., 2012). Additional analyses using major depression only were also conducted. Past-year depressive symptoms were assessed using the Composite International Diagnostic Interview Short-Form (CIDI-SF), a clinically-validated screening instrument (Kessler et al., 1998). To meet criteria for depression, a person must have two or four depressive symptoms (minor depression) or five or more depressive symptoms (major depression), present for more than half of the days, for at least 2 weeks, with at least one of these symptoms being either depressed mood or loss of interest. The CIDI-SFMD diagnosis has good criterion validity compared with structured psychiatric interviews (sensitivity 90%, specificity 94%) (Kessler et al., 1998). Participants were also asked if they had been prescribed antidepressant medications during the last year. People taking antidepressants may not exhibit depressive symptoms at the time of the interview and be misclassified as not depressed. In sensitivity analysis, we changed the outcome to include those taking antidepressants as meeting the criteria for depression.

### 2.3. Neighbourhood characteristics

#### 2.3.1. Definition of neighbourhood scale

We used a person-centered approach to define neighbourhoods. We created a radius buffer around the center of the postal code of each participant and measured the neighbourhood characteristics within the zone. The postal code is a six-character alphanumeric code that forms part of the postal address in Canada. It may indicate a specific city block, a single building, or a large volume mail receiver (Canada Post, 2014) and has been shown to be a good proxy for the full home address (Bow et al., 2004). The median number of individuals living in a postal code ranges between 8 and 25 across Canadian provinces (Electronic Health Information Technology, 2011). The radius buffer accounts for road networks and geographic obstacles (e.g., rivers). Because there is no consensus on the neighbourhood scale that is more important to depression, we conducted sensitivity analyses using 250 m, 500 m, 1000 m and 1500 m buffer radius sizes to determine which was most relevant to our study. We compared strengths of associations and goodness of fit indices (Akaike information criterion and the Bayesian information criterion) of univariate models using the different buffer sizes. Results suggested that the 500 m buffer radius had the best fit overall (Supplementary Table 2) and was therefore used in this study. The NPHS provided information on address change and we used the latest postal code of participants at each survey cycle. We used neighbourhood data that were closest in time to each survey cycle to approximate the neighbourhood characteristics at that time.

#### 2.3.2. Material and social deprivation

The Pampalon et al. (2012) index was used to assess neighbourhood deprivation in 2001 and 2006. The index was constructed through a principal component analysis using six census variables resulting in two factors: material and social deprivation. We created quintiles for social and material deprivation, from least